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GENERAL NOTE

Sometimes requests are received for printed information describing more fully an investigation mentioned in the Technical News Bulletin. Because of the current nature of much of this work, often such material cannot be supplied. However, in such cases, when the investigation has progressed sufficiently far, the Bureau will make every effort to answer specific inquiries concerning particular applications of the subject, thus avoiding the delay incident to publication.

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1 The Establishment of Standards for Large Gas Meters

The work of the Bureau of Standards in connection with measurements of the flow of gas at Edgewood Arsenal and Chicago was mentioned in Bulletin No. 88, Item 13. The experimental work is now practically completed. The investigation at Edgewood Arsenal was conducted entirely by the Bureau, and was concerned with orifice meters only, while the one at Chicago was in cooperation with the American Gas Association and the Natural Gas Association, the experimental work being carried out in the plant of the Peoples' Gas Light and Coke Co. This investigation included in its program a wet drum station meter, a cycloidal type meter, a venturi tube, a Thomas electrical gas meter, and a large gas holder, in addition to the orifice meter. These tests were made at low pressures, amounting to less than a pound per square inch, while the tests at Edgewood were made at high pressures, such as are sometimes used in natural gas mains.

The tests at Edgewood and Chicago were tied together by testing the nozzles used at Edgewood against the holder and other meters employed at Chicago.

The value of this work arises from the rapid increase

in industrial uses of gas, with demands varying from a few hundred to a few million cubic feet per hour. Also there are many gas companies who buy more or less of their gas supply for distribution and resell it to their industrial and domestic customers. For example, the Peoples' Gas Light and Coke Co. of Chicago buys many millions of cubic feet of gas per day. If one of the meters through which this gas is measured is in error by 1/2 per cent, and the price of gas, wholesale, is 50 cents per thousand cubic feet, the inaccuracy of the meter would represent $2.50 per million cubic feet. Where the meter passes 10 or 20 or more millions of cubic feet per day, the rapidity with which the loss to one party or the other builds up is apparent.

In the field of natural gas, the measurement of fairly large volumes of gas, and particularly at considerable pressures, is of importance. It is not uncommon for a transmission company to buy gas from individual well owners and to pipe it to the limits of towns where another company retails it to the consumers. It is recognized as the best practice to have the transmission company measure both the gas it buys and the gas it sells. Failure to do this results in considerable waste of gas. Leakage and loss can be detected and prevented by measuring the gas entering and leaving the transmission line, and a distributing company which pays for gas upon the basis of a meter's readings will have a greater incentive to keep its lines tight than would be the case if it paid the transmission company a percentage of its retail sales.

In the tests at Edgewood Arsenal the Bureau secured the use of four heavy compressors for supplying the air. A series of test lines, consisting of 4, 6, and 8 inch pipe was set up, with a short section of 3-foot pipe at the outer end. The discharge from the 3-foot pipe was through a flow nozzle which formed the primary standard. The rate of flow which could be obtained from the compressors ranged up to about 110,000 cubic feet of free air per hour for pressures up to 75 pounds per square inch, and up to about 75,000 cubic feet per hour for pressures between 75 and 250 pounds. While most of the tests were at pressures below 75 pounds, a number between 75 and 250 pounds were made. The ratios of orifice to pipe diameter ranged from 10 to 70 percent. The differential pressure ranged from a few inches of water to nearly 100 inches of mercury, or about 50 pounds per square inch. In connection with the work several different orifice shapes were tested.

In the Chicago test the object was to obtain a large rate of flow rather than even moderately high pressures, and in several of the tests rates of flow up to 600,000 cubic feet per hour and over were obtained. The pressure, however, in no case exceeded 30 inches of water, or about one pound per square inch above atmospheric. The test line was arranged so that all the meters could be operated in series, but means were provided for by passing the wet drum and cycloidal meters, and in a large proportion of the tests this was done. In addition to the tests between the several meters, a considerable number of tests were made against the holder as a standard. The inner lift of the holder, which was the only lift used, has an available displacement capacity of about 500,000 cubic feet. Great care was taken in the tests to insure that the gas in the holder was saturated with water vapor, and the means employed for controlling and measuring the gas within the holder were quite elaborate. It is believed that the uncertainty of the temperature measurements is less than one degree Fahrenheit.

2 The Use of Glue for Coated Paper

In a paper presented at the meeting of the Technical Association of the Pulp and Paper Industry in Buffalo, N.Y. on October 15th, Dr. V.H. Gottschalk, Research Associate at the Bureau of Standards, discussed results so far obtained in the investigation of the use of glue as an adhesive for applying clay coating to paper.

This investigation is being conducted in cooperation with the National Association of Glue Manufacturers. The work was undertaken at a time when market conditions threatened to force the use of glue as a substitute for casein in the manufacture of coated paper, and hence the primary object was to gather data and information that would be of immediate use in aiding the coating mills to make the change that seemed imminent. While the need for this emergency work disappeared with the turn in the market price for casein, the investigation has been continued, because both the price and supply of casein are subject to constant fluctuation; because it seems probable that the price of any product having the food value of casein must eventually become prohibitive for such industrial uses; and because the variation in the quality and properties of casein have led to a demand in the coating industry for a satisfactory substitute.

The coating equipment of the Bureau used for this work consists of a 14 inch Waldron Flat Bed Brush Coater with fes-

toon dryer and rewinder. In addition to the coating tests made at the Bureau, several test runs have been made in a commercial coating mill. Preliminary commercial printing tests of the coated papers have been obtained.

The conclusions based on results obtained are summarized as follows:

(1) The amount of glue needed in a coating mixture varies almost directly with the grade of the glue chosen, and this amount is not greater than five-fourths, and may actually be less than, the amount of best casein that is used in present day coating formulas.

(2) The coating technique with glue is the same as with casein except for the necessity of regulating the temperature of the clay-glue mixture.

(3) The water-resistance of glue-bound coated paper can be improved, if desired, by the use of small amounts of chrome alum. It is suggested that regulating the acidity of the coating mixture may also be a factor in water-resistance. The need for an extraordinary degree of waterproofness and of water-resistance in any but high grade lithograph paper is questioned.

(4) The printing quality of glue-bound, clay-coated paper, as far as can be judged from a small number of preliminary printing tests, is satisfactory with present day printing inks.

(5) A study of the colloidal properties of coating clays is a desirable preliminary to further work on the clay-suspending power of glues and on the elimination of the mottling in coated papers.

(6) Uniform results in the coating of paper may be attained by the use of glue bought on specification. A brief discussion of the specifications for coaters glue is given.

(7) It is possible by the use of glues of a higher grade to make coated papers containing less adhesive than is used in the commercial casein-bound papers. This presents the possibility of making coated paper of better folding quality than is ordinarily obtained.

3. The Development of a Domestic Polishing Leather

The Bureau was able recently to assist a manufacturer of cutlery in connection with the leather used on the rough polishing wheels during the finishing processes. According to information given by the manufacturer it was not possible to secure an American leather satisfactory for the purpose, and it was therefore necessary to import material from a

foreign country at a high cost. This imported leather also had to be subjected to a further treatment in this country, which also added to the expense.

Samples of the imported leathers both before and after the special treatment were received. As reflected by the chemical tests the leather contained a slight trace of chrome and about 3 per cent of grease. The only difference between the treated and untreated leather was that in the former the grease content was less than one-half of one per cent. The sole effect of the special treatment was that of degreasing the leather, and an immediate saving was effected since the manufacturer could readily do this himself after being advised as to the situation.

Several samples of American leather were furnished the manufacturer for test purposes and finally one was found which he advised gave complete satisfaction. This leather was tanned by a combination of the chrome and vegetable process.

Through this work the Bureau was able to effect a material saving and also to make possible the use of a domestic rather than foreign product. In commenting on this assistance the manufacturer stated that the service was of substantial value and importance to the industry.

4 Wearing Qualities of Textiles

The Bureau has just completed a short experiment on the proper tension to be applied to fabrics while being tested for abrasion. The work on the wearing qualities of textiles, of which the above experiment forms a part, has produced some very interesting data for consideration by the user and manufacturer of these materials. The difficulty encountered in developing a method for testing the wearing qualities of textiles in general was due to the many uses to which materials are put. For example, one test may be on specimens of carpet and the next on the lining of a woman's suit. Consequently, the methods of applying this wearing test or service treatment necessarily differ according to the material and its use.

In the case of plushes for railroad car seats an abrasion test was used where notations were made on the rate at which the pile fell off or pulled out in terms of loss in thickness of the material, including pile. For overcoating of soft material with considerable nap, the amount of abrasion to cause the material to appear threadbare required a separate method of test. On satins it was necessary to measure the degree of roughing required to distort the usual arrangement

of threads, and this necessitated another test method. For serges, and similar worsted materials, the loss in physical strength before and after required a still further test.

The work to date can be summarized as an effort by the Bureau to establish a suitable apparatus and a suitable method of test for each material having a different use, and to explain why materials become undesirable, also to determine the controlling items such as grade of wool, twist, crimp, felting or degree of shrinkage, and tension, chemical treatments, and other items characteristic of each class of material.

5 Measurement of Heat Insulation and Related Properties of Blankets

For a considerable time the Bureau has been working on the problem of a standardized test for the heat-retaining value of textile fabrics. As a result of this investigation, Technologic Paper No. 266 has just been issued, covering the preliminary results of the work. Copies may be obtained from the Superintendent of Documents at 10 cents apiece.

It is pointed out that the problem of the passage of heat through fabrics is one of heat transmission rather than conduction. Likewise, fabrics are all relatively permeable to air and moisture, and these properties may influence the passage of heat through the fabric. Therefore, three sets of testing apparatus were designed, the first for measuring the permeability to air, and the second to water vapor, but both of these are considered of secondary importance as compared with the third, which measures the heat transmission.

This property is measured by a duplex testing apparatus, fully described in the pamphlet. In this set-up precautions are taken to prevent heat exchange between the two main heaters of the duplex assembly, as well as lateral flow of heat from the edge of the heaters. Therefore, unidirectional heat flow takes place from the two main heaters, and the rate of transfer through either of the two specimens may be measured.

The specimens are mounted under a tension of one percent of the predetermined breaking strength for warp and filling directions. This removes irregularities of thickness in the fabric caused by folds and wrinkles, without altering appreciably the normal structure.

The method of test procedure is described, and data from several tests on new blankets, representative of those to be obtained in the trade, are presented and analyzed. Two equations for thermal resistance of a fabric are given, each holding true for a certain range of density of fabric.

6 Methods of Calculating Hosiery Shipping Case Dimensions

Methods for calculating the dimensions of the most suitable arrangement of hosiery boxes to obtain a minimum surface area of the supiing case, using both the Bureau's proposed standard inside dimensions of hosiery boxes and boxes of other dimensions, are given in Circular 169 of the Bureau of Standards. Copies may be obtained from the Superintendent of Documents at ten cents each.

In the appendix to this circular, the equation for a hexahedron of given volume and minimum surface is shown to be

$$c = \frac{2K}{K + 1}$$

In this equation c and K are constants, and the sides of the hexahedron are a, Ka, and ca. A cube is shown to have the smallest area, and a graph shows the relation when various values are assigned to K. The calculations of the most economical dimensions show the possible arrangement of the boxes and the dimensions of this arrangement. The minimum in each style is taken as 100, and the other arrangements show the percentage of additional surface required. The minimums are grouped, and sizes are listed for the use of the manufacturer.

7 Preparation of Standard Specifications for Whiteware Pottery

A Master Specification for Vitrified Chinaware has been finally accepted and became effective on Nov. 5, 1924, as Federal Specifications Board Specification No. 243. This master specification for the purchase of vitrified chinaware has been evolved after an investigation covering a period of several years, in which manufacturers of vitrified chinaware through their Association have cooperated with the various Government departments using this material, and with the Bureau of Standards in which the laboratory work was carried out. The specification covers material known as thick china, hotel or rolled edge china, and medium weight china. The material, workmanship, and general requirements are given, as well as the detailed requirements in which there is defined in numerical values the resistance which this type of ware shall show to impact, chipping, and temperature change in order to be satisfactory. The specification further presents a detailed list of the trade size, actual size, maximum weight, and tolerance in size of every piece of ware which shall be used by the Government in its dining room service, enlisted men's service and hospital service.

When the preparation of this specification was undertaken by the Federal Specifications Board the Bureau of Standards was entrusted with the investigational work.

In the course of this investigation practically every make of vitrified chinaware manufactured in this country was tested, as well as several well known brands of chinaware from England, France, Germany, and Japan. The information obtained is considered as confidential, and the comparative value of the different brands cannot be supplied. It is believed, however, that the specification, a copy of which will be sent to interested parties on application to the Chairman, Federal Specifications Board, Bureau of Standards, Washington, D. C., will furnish sufficient data to be used as a basis for the purchase of vitrified chinaware for general use.

8 Problems Relating to Saggers

Chinaware to be succesfully burned and glazed must be carefully placed in heat-resistant containers, known as saggers. These prevent the flame and soot present in the kiln from harming the ware. Saggers are also used in the tile, abrasive, and other clay industries where burning of the product requires great care. It is desirable to have these saggers made of clay of considerable strength and of good refractory quality.

The Bureau, in cooperation with the United State Potters' Association, is conducting an investigation which involves a geographical study of sagger clays and their classification according to properties. It has for its ultimate purpose the increase of the life of the sagger, thereby assisting the manufacturer who finds the cost of saggers discouragingly high due to unsatisfactory service.

Approximately 10,000 routine tests made on the fifty-five clays included in this investigation have given the following information: The water of plasticity was found to range from 16 per cent to 46 per cent and the drying shrinkage from 10 per cent to 20 per cent. In the unburned state the porosity was found to vary from 24.5 per cent to 50 per cent, and the transverse strength ranged from 50 pounds per square inch to 380 pounds per square inch. The lowest softening point of these clays was equivalent to that of Orton cone 14, from which point they ranged to higher than cone 33. Specimens of each clay were subjected to five progressive burns, ranging from 1150°C to 1310°C, with an increase of 40°C between succeeding burns and all of the clays except three were not overburned at the highest temperature. Clays burned to 1150°C showed a porosity ranging from 19.5 to 46.5 per cent, and a volume shrinkage ranging from 1.9 to 16 per cent, while after burning to 1190°C, the porosity varied from 14 to 46 per cent and the volume shrinkage from 2.7 to 18 per cent. After burning to 1230°C the porosity ranged from 8 to 40.8 per cent and the volume shrinkage from 4 to 24.7 per cent,

while after the 1270°C burn the porosity varied from 1 to 38.5 per cent and the volume shrinkage from 2.1 to 35.7 per cent. The final burn (1310°C) produced a porosity varying from 8.8 to 39 per cent and a volume shrinkage varying from 2.5 to 18.5 per cent. Incomplete data covering the transverse strength tests indicate the strength to increase with succeeding burns up to 1270°C, while at 1310°C a large number of the clays show a decrease. The lowest burned transverse strength determined was 800 pounds per square inch, while the highest was 5300 pounds per square inch.

Cooperation by manufacturers permitted the repeated burning of a number of clays and mixtures of clays to as many as 26 burns under actual plant conditions. Specimens were returned by the potteries to the Bureau at intervals of three burns, and progressive changes in their physical and chemical properties studied. Data collected indicate that repeated burnings have very little effect on the properties of these clays.

A preliminary comparison of the results of the microscopic examination and the results of the physical tests have shown that the behavior of the clays depends to a certain extent upon the kinds and relative amounts of the minerals in the raw clays and the relative amounts of quartz, glass, and $3Al_2O_3.SiO_2$ crystals present in the burned body. After all preliminary data are collected, additional work will be done on the groups into which the clays are classified.

9 Use of Hydrated Lime in Portland Cement Mortar

It is quite common practice to add hydrated lime to Portland cement mortar, to improve its working qualities, while on the other hand Portland cement is added to lime mortar to hasten its set and increase its strength. The quantities of each material vary with the locality and the opinion of the user. Obviously there is a mix best adapted for given conditions. The determination of these mixes has been the subject of many investigations covering a number of years. An investigation has been completed at the Bureau dealing with the measurement of plasticity, time of set, yield, shrinkage, and tensile strength, together with a resume of the literature upon these subjects. Many interesting points have been brought out, including:

(1) The richer the cement mortars, and the higher the percentages of lime which they contain, the more mixing water is required to bring them to a given consistency.

(2) A cement mortar to which lime has been added requires additional water, but this additional water increases shrinkage possibilities; therefore lime should be limited in cement

mortars where it is desirable to keep the shrinkage low. The principal advantages of the lime are that it increases workability, tends to prevent segregation and may reduce permeability if used in the proper proportion. Lime retards the set of cement mortars.

(3) The substitution of lime for an equal volume of cement always results in a decrease in strength. The substitution of lime for an equal weight of cement can not be expected to increase the strength of a cement mortar which is richer than 1:4.

(4) The desirable properties of cement-gaged lime mortar are short time of set, strength, elasticity, and workability.

A study of the literature indicates that: Inert, powdered admixtures possess positive merit for reducing permeability of mortars to water when applied to mortars that are not too rich; the strongest mortars may not always have the greatest adhesion; extra sand reduces adhesion of mortars; the strength of masonry depends upon the strengths of brick, mortar, and bond between mortar and brick.

10 Impact Stress in Concrete Stadium

While planning repairs for a large reinforced concrete stadium the question arose as to whether the girders possessed sufficient strength to permit adding a considerable dead weight to the present structure. Extensive load tests carried out recently showed extremely slight deflections and indicated ample strength when static load was considered. Application was made to the Bureau of Standards for a test to determine whether moving loads causing impact and rythmic deflections would set up stresses great enough to reverse the conclusions based upon static loads. For this purpose electric telemeters of the type described in Technologic Paper 247, were used, and observations of stresses in the reinforcement of beams and girders were made during the entire progress of a recent foot ball game whem the stadium was loaded to full capacity. The results have not been fully studied but it is clear that stresses due to all causes were very low. The indication is that the static live load stress in the steel did not exceed one thousand pounds per square inch and that the stress due to impact or moving load of any kind did not exceed three hundred pounds per square inch. The instrument apparently behaved well and no reason is known for doubting the indications from the tests. These results will probably prove an important contribution to available information regarding behavior of such a structure under loads causing impact. Caution is needed, however, in applying such results in other

cases. A structure having less weight or a different period of vibration might show a greater stress.

11 Deterioration of Sheet Lead in Contact with Portland Cement Mortar and Concrete

A number of requests are received at the Bureau from time to time for information on the question of the deterioration of sheet lead when in contact with portland cement mortar and concrete. Some two years ago this question came up in connection with lead sheathing on power cables and in cooperation with an electrica power company a few exposure tests were made on specimens of lead sheathed cables.

Six peices of cable about one foot long and with one end soldered were imbedded to a depth of nine inches in a stiff portland cement mortar made of one part cement and two parts sand. The mortar coating was 3/4 inch thick and the soldered ends were placed in the mortar. Three specimens were coated with plain mortar and three were set in mortar containing 2 per cent of pulverized sodium silicate (per cent by weight of cement). One of each type of specimen was stored under three conditions of storage, as follows: air of the laboratory, the specimen being wetted occasionally; immersion in water to within one inch of the top of the mortar; and moist air of a damp closet.

After two years and three months exposure to these conditions the mortar coating was removed and the lead sheathing examined. The specimens under dry storage were practically unaffected with the exception of a very slight yellowish tinge on the surface of the lead. The specimens stored in water showed only a trace of oxide near the top line but were free from this over most of the surface. There was apparently some electrolytic action near the soldered end where the lead was bright and slightly surface eaten or pitted. The specimen encased in the plain mortar showed slightly more attack than the sodium silicate mortar specimen. The two specimens in the damp closet were more or less covered with a hard but thin coating of yellow oxide. The coating on the plain specimen was slightly heavier than on the sodium silicate specimen especially near the top and bottom. Signs of pitting were apparent only in one area on the plain specimen.

These limited tests show that corrosion of lead occured in contact with the mortar and that the addition of the sodium silicate to the mortar did not make a marked difference in results.

In view of the wide use of sheet lead in shower bath installation and from the above test results the Bureau makes the following suggestions in order to obtain satisfactory in-

stallations; That not lighter than six pound lead be used and that the sides be turned up at least two inches above the floor level. The corners should be turned up and not soldered. The concrete base upon which the lead pan is laid should have a smooth finish and be given a coating of bituminous paint before the pan is set. The top of the pan should have a similar coat before the topping is laid. The topping used above the panshould be a 1:3 cement sand mortar and during the laying of this care should be taken to protect the weep holes in the trap by some means as placing a layer of gravel about 3/8 inch size around the trap for a considerable area.

12 Effect of Ultra-Violet Light on Metals

Apparatus has been constructed and plans outlined for the study of the surface changes produced on metals by ultra-violet light acting in various gases, which it is hoped will give data of interest on surface films and the mechanism of corrosion.

Previous mention of this phenomenon will be found in Item 9 of T.N.B. No. 86.

13 Peculiarity in the Expansion of Iron and Steel

An Italian metallurgist has reported an anomaly in the thermal expansion of iron and low carbon steels around 370°C when sufficiently accurate expansion measurements are made. Some specimens studied at the Bureau some time ago indicated a thermal change below 500°C but later repitition of the thermal study failed to show it. It is possible that these effects may be due to hydrogen, and work is under way to study the expansion by direct length measurements and by the interferometer method of specimens heated in hydrogen and cooled in it. Further extension of the work will be made if the results warrant.

14 Gases in Charcoal and Coke Cast Iron

A report was recently made by W. E. Jominy of the University of Michigan on a comparison of some of the properties of charcoal and coke gray cast irons. His report shows that the average values for Brinell hardness, transverse strength, tensile strength and deflection for a considerable number of heats of charcoal irons are appreciably higher than for a similar number of coke irons of closely comparable chemical composition. Such differences did not disappear on a remelting of the cast irons. Some years ago J.E. Johnson, Jr. stated that similar differences in strength of cast irons were due to differences in the oxygen content of the metal. The Bureau has been supplied with samples of most of the irons listed by Mr. Jominy and will make analyses for oxygen by the vacuum fusion method in the attempt to throw some light on the supposed influence of oxygen in such material.

15 Vacuum Fusion Method of Analysis for Oxygen and Hydrogen in Metals

Check analyses made by this method on solid samples of a metal often do not agree as closely as is to be desired. In order to determine whether these variations were due to inability of the method to give sufficiently accurate results or were due to non-uniformity in the metal samples which cannot be eliminated (when using solid samples) by mixing of the sample as in usual chemical analyses, determinations were made on samples of thoroughly mixed chips of some of the Bureau's standard samples. Duplicate analyses in all of these cases gave very satisfactory checks, indicating that variations in duplicate analyses on solid samples probably indicate real variations in the gas content of different portions of the given metal.

16 Study of Quenching Media

Quenching experiments were conducted during the past month with solutions of widely different physical properties in order to deveop, if possible, those factors of greatest importance contributing to high "hardening power". No general conclusions can be drawn until further experiments and compilation of data have been made.

It is interesting to note that the addition of as little as 0.003% by weight of sodium oleate to water at 20°C reduced the cooling velocity at 720°C from 150 to about 35°C per second; likewise 0.06% by weight of "White Dove" soap caused a decrease from 150 to about 25°C per second. The first mentioned solution is extremely unstable and "broke down" when used for the second time.

Ethyl alcohol (95%) was found to have the lowest "hardening power" of any liquid so far tested.

Experiments with sodium chloride brines at 20°C indicate a material decrease in hardening power as the concentration of salt in the water is increased above about 20 per cent.

Equipment for experimental study of pressure quenching has been designed and parts ordered.

17 The Bond Strength of Molding Sand

A preliminary study of the development of bond strength of molding sand by milling has been made. In some cases the bond strength was greatly increased without appreciably affecting the permeability. This is in agreement with recent tests by Hansen of the General Electric Co. A study of various methods of determining the clay substance of molding sand has been carried out, and will be extended to other possible methods.

18 Analysis of Phosphate Rock

A paper on the analysis of phosphate rock, by G.E.F. Lundell and J.I. Hoffman was published in the Journal of the Association of Official Agricultural Chemists, Vol. 8, page 184. An abstract of this article is as follows:

Methods for the determination of moisture, phosphoric acid, "soluble iron and alumina", and calcium are given, together with results obtained in the analysis of the Bureau of Standards standard sample of phosphate rock by the use of these and other methods.

The use of boric acid is desirable in preparing solutions for the analysis of phosphate rock, for this lessens the interference of this acid in determinations of phosphorus.

Results obtained by solution of the ammonium-phosphomolybdate precipitate with magnesia mixture can not be correct except through compensating errors, for the precipitate always contains molybdenum and is rarely of ideal composition. If magnesia mixture is added too slowly to neutral or ammoniacal solutions of phosphate, the results are usually low. For accurate analyses, solution of the magnesium ammonium phosphate precipitate is recommended, followed by the addition of 2 - 3 cc of magnesia mixture and reprecipitation by ammonia.

In the alkalimetric method for phosphorus, the solution should not be heated after the addition of the molybdate reagent. The 23 : 1 ratio can not be used in calculating the phosphorus titre of the sodium hydroxide solution unless the method is carefully worked out and followed to the letter.

It is not difficult to get concordant results for "soluble iron". The determination of "soluble alumina", on the other hand, requires rigid attention to a defined method of solution and careful analysis if comparable results are to be obtained.

19 Standard Samples

Most of the reports on the analysis of Sample No. 65, Acid Electric Steel, and Sample No. 66, Spiegeleisen, have been received, and these samples have been issued during the past month with provisional certificates. The machining of the renewal for Cast Iron No. 5d has been started, and it is hoped that this much needed standard can be analyzed and put in stock by January 1.

20 Molasses Tests for the Customs Service

In connection with the testing of imported molasses in the laboratories of the U.S. Customs Service, it has been the practice to have each port submit one sample per month to the Bureau of Standards for test, together with the results obtained by their laboratory. Satisfactory agreement

has been obtained on these samples, but in view of the importance of the tests on this product it was decided to submit from time to time samples to all the laboratories of the service for test. It is thought that by such a procedure a better check will be maintained on the accuracy of the work at the different ports. At the same time it will be possible to vary the samples submitted so that the chemists of the Customs Service will get experience in the analysis of all the different grades of commercial molasses. A composite mixture of blackstrap molasses was prepared at the Bureau and samples submitted to the different laboratories. The results will be forwarded to the Bureau, where they will be compared with the results obtained in the Bureau's laboratories.

21 Some Observations on Aluminum Paints

The use of aluminum paints on iron and steel structures is discussed in an article in the November 5 number of Chemical and Metallurgical Engineering, by P.H. Walker and E.F. Hickson of the Bureau of Standards. The more important points covered in this paper are as follows;

The durability of aluminum paints on iron and steel was determined, and suitable mixing formulas for such paints were worked out. Photographs of the painted panels are shown. Raw and boiled linseed oils are not good vehicles for aluminum, especially on vertical surfaces. Two to 2½ pounds of aluminum powder to 1 gallon of either long oil water-resisting spar varnish, 2/3 spar varnish and 1/3 boiled linseed oil, or heavy bodied linseed oil with thinner and drier are recommended as durable aluminum paints for outdoor exposure. Aluminum paints containing spar varnish (free of lead) are resistant to sulphide fumes. The "leafing" properties of aluminum paints are shown by photographs.

22 Paints Resistant to Sulphide Fumes

The following is a brief abstract of a paper on the resistance of paints to sulphide fumes published by P.H.Walker and E.F.Hickson of this Bureau in Industrial and Engineering Chemistry, Vol. 16, page 1142.

Ammonium sulphide is more detrimental to the color of paints than hydrogen sulphide, owing to the action of both the hydrogen sulphide and ammonia fumes.

For the interior painting of chemical laboratories and other places subjected to sulphide fumes, flat lithopone wall paints of the type specified in U. S. Government Specification No. 21 are recommended. If white is desired as the color, the paint should be free from lead. The use of a cobalt drier is

recommended. For gloss finishes a lithopone paint of the type specified in U. S. Government Specification No. 67 is recommended; the same provisions for the absence of lead in the paint, either in white or tints, hold true. Ammonia fumes, however, will be more detrimental to the color of these gloss finishes than to the flat finishes.

For exterior painting around places subjected to sulphide fumes, the use of a titanium pigment-zinc oxide paint free from lead is recommended.

23 Conference on Electroplating

A conference of electroplaters was held at the Bureau of Standards on November 14 and 15. The papers presented covered the progress which has been made in the Bureau's laboratories in connection with electroplating research as well as the experience of those engaged in the commercial application of the subject. Valuable suggestions were made as to the lines along which future research can most profitably be directed.

Mr. C. T. Thomas of the Bureau's staff presented a paper covering the protective value of nickel deposits. This was illustrated by exhibits of specimens which had been plated with nickel and then subjected to various corrosive agencies. In the present state of the art, it was brought out, the protection afforded by nickel plating is far from complete, and it does not seem likely that any single discovery will solve the problem once for all. It will be a matter of slow improvement in plating methods as the result of increasing scientific knowledge of the process of electroplating and of the numerous variable that affect it.

Mr. M. R. Thomas, also of the Bureau's staff, described the studies now in progress in connection with the nickel plating of zinc and die castings. This is an important matter because of the increasing use of die castings for automobile trimmings and other nickel plated objects which were formerly made of brass. The metals used for making such parts are largely alloys containing zinc, and are cast in steel molds which can be used over and over.

Other researches in progress at the Bureau were discussed, including studies of nickel anodes, the effect of impurities in nickel salts, measurements of the hydrogen ion concentration, and the throwing power of nickel-plating solutions. The ideal solution would be one that would give an even deposit all over, and this is still far from being attained. It is now possible, however, to make a solution which will give much better distribution of nickel than could be obtained a few years ago.

Appropriate subjects for future research at the Bureau and elsewhere were discussed; these including methods of plating various metals, methods of analysis, and instruments for measuring the properties of solutions and of deposits. The best means to secure effective cooperation between the Bureau of Standards, the American Electroplaters' Society, the American Electrochemical Society, and other technical organizations was also considered, as well as proposed specifications for nickel and silver plating, and the technical education of electroplaters by means of classes at the factories and through college courses in electrodeposition.

About 45 delegates attended the conference, which was followed by an inspection trip through the Bureau's laboratories.

24 Balanced Transformer Method of Measurement at Radio Frequencies

In an article entitled "Measurements at Radio Frequency," by Dr. A. Hund of the Bureau of Standards in the November 8, 1924 issue of the Electrical World, there is given a method for the rapid determination of effective resistance and inductance of coils or straight conductors. The measurement involves a balance between the test sample and a variable condenser in series with a variable resistor, the adjustment being secured by means of a balanced transformer. The method covers the range of frequencies used in radio work and has the advantage that the test sample is in the circuit at the same time as the standards and that the indicating instruments are inserted in portions of the system where they have no effect on the measurements. The method is independent of the impressed electromotive force. The usefulness of the method is shown by actual measurements which arecompared with results obtained by other methods. Practical hints as to shielding and essential details are given at the end of the paper.

25 Standard Radio Frequency Transmissions

The following schedule will be used in sending out standard frequency signals from the Bureau of Standards (WWV) and Stanford University (6XBM) during December, January, and February.

Schedule of Frequencies in Kilocycles.

(Approximate wave lengths in meters in parentheses).

Time*	Dec.19	Jan.5**	Jan.20	Feb.5**	Feb.20
10:00 to 10:08 p.m.	550 (545)	2000 (150)	1500 (200)	3000 (100)	125 (2400)
10:12 to 10:20 p.m.	650 (461)	2200 (136)	1650 (182)	3300 (91)	133 (2254)
10:24 to 10:32 p.m.	750 (400)	2500 (120)	1800 (167)	3600 (83)	143 (2097)
10:36 to 10:44 p.m.	833 (360)	3000 (100)	2000 (150)	4000 (75)	155 (1934)
10:48 to 10:56 p.m.	1000 (300)	3500 (86)	2200 (136)	4400 (68)	166.5 (1800)
11:00 to 11:08 p.m.	1200 (250)	4200 (71)	2450** (122)	4900 (61)	205 (1463)
11:12 to 11:20 p.m.	1350 (222)	5100 (59)	2700** (111)	5400 (55)	260 (1153)
11:24 to 11:32 p.m.	1500 (200)	6000 (50)	3000** (100)	6000 (50)	315 (952)

*Eastern standard time for WWV, Washington, D.C. Pacific standard time for 6XBM, Stanford University, California.

**The schedules marked with this sign are tentative for station 6XBM, Stanford University; later announcement will be made if there is any change.

26 Standard Frequency Stations

The following stations have been found furing the past month to maintain their transmissions so nearly on the assigned frequency that they can be used as frequency standards:

Station	Owner	Location	Assigned frequency (kilocycles)	Period covered by measurements (months)	No. of times measured.	Average deviation from assigned frequency	Greatest deviation from assigned frequency since Oct.20, 1924.
						Per cent	Per cent
NSS	United States Navy	Annapolis,Md.	17.50	15	110	0.2	0.5
WGG	Radio Corp.of America	Tuckerton,No.1, N.J.	18.86	15	119	.2	.2
WII	Radio Corp.of America	New Brunswick, N.J.	22.04	14	101	.2	.1
WSO	Radio Corp.of America	Marion,Mass.	25.80	15	94	.3	.2
WWJ	Detroit News	Detroit,Mich.	580	15	46	.1	.3
WCAP	Chesapeake & Potomac Tel. Co.	Washington,D.C.	640	14	66	.1	.2
WRC	Radio Corp.of America	Washington,D.C.	640	11	44	.1	.2
WSB	Atlanta Journal	Atlanta,Ga.	700	14	59	.2	.9
WGY	General Elec. Co.	Schenectady, N.Y.	790	17	99	.2	.1
WBZ	Westinghouse Elec. & Mfg. Co.	Springfield, Mass.	890	7	17	.0	.1
KDKA	"	East Pittsburgh, Pa.	920	14	126	.1	.1

PUBLICATIONS OF THE BUREAU OF STANDARD RELEASED DURING NOVEMBER

Technologic Papers

T 263 Tangent modulus and the strength of steel columns in tests, O. H. Basquin 20¢

Miscellaneous Papers

M 60 Annual Report of Director of the Bureau of Standards for fiscal year ended June 30, 1924.

Simplified Practice Recommendations

R 16 Lumber 15¢
R 17 Forged tools 5¢

These publications can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the prices given above.

Respectfully,

George K. Burgess,
Director.
HGB